

Chemical markers of tracked pelagic seabirds as indicators of human impacts in offshore marine ecosystem

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Warming trend, fisheries, and pollution may impact marine ecosystems. Monitoring these impacts, however, is logistically challenging especially in the offshore. To use seabirds as the monitors of climate and human impacts in the offshore ecosystem, our group have been tracking the year-round movements of two species of migrant (streaked-shearwaters, SKSH; short-tailed shearwaters, STSH) using geolocators and conducting the measurements of the mercury (Hg) and the stable isotope values in the breast-feathers, that were inferred to replace during breeding, and the outermost primary (P10) or tail-feathers (R6), that were inferred to replace during non-breeding. SKSH used the western North Pacific during breeding and the sea off southeastern Asia during non-breeding, while STSH used the Southern Sea during breeding and the northern North Pacific during non-breeding; with large individual variation in the wintering ground in both species. Breast feather [Hg] was high (6ppm) in SKSH, while low (1 ppm) in STSH, presumably reflecting higher pollution level in the central NW Pacific than in Southern Sea. Hg in P10 of STSH and that in R6 of SKSH showed large individual variation across the non-breeding ground: higher in SKSH spent non-breeding in South China Sea (2.5 ppm) than those in the Pacific north of New Guinea (<1 ppm) and higher in STSH spend non-breeding in the Okhotsk-northern Japan Sea (2.5 ppm) than those in the south eastern Bering Sea. (<1 ppm). There were regional and individual variation in the nitrogen ($\delta^{15}\text{N}$) and carbon stable isotope ratio, while effects of $\delta^{15}\text{N}$, a proxy of trophic level, on the mercury contents was not obvious. With more knowledge of molting pattern, turnover rate and metabolism of chemical markers, and bio-magnification factor and base-line marine iso-scape, the chemical markers in the bird tissues conjunction with tracking data can make seabirds as more useful sentinel of marine ecosystems in ecologically and biologically significant areas.